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(54) Torsional vibration damper

(57) A torsional vibration damper has a preliminary damping device (2) and a main damping device (3), in which force accumulators (24, 13) are operative between the input and output parts of these damping devices and the output part of the torsional vibration damper is an internally splined hub part (11), on which the output part (20) of the preliminary damping device as well as a flanged part (8) which forms the output part of the main damping device (3) and has a shaped interior, are mounted so as to be fixed for rotation therewith. The shaped interior is in engagement with the shaped exterior (10) of the hub part (11) and a limited amount of relative rotation of the flanged part (8) of the main damping device with respect to the output part of the torsional vibration damper is made possible by these shaped parts. At least one of the input parts (5, 7) of the main damping device (3) is mounted on a shoulder (39) of the hub part (1) forming the output part of the torsional vibration damper by means of an L-shaped friction or bearing ring (37) and between the L-shaped ring (37) and the shaped exterior part of the hub is arranged a corrugated spring (41) which is supported on one side against the latter, and on the other side, urges the side plate (5) mounted by the L-shaped ring (37) in the direction away from the shaped exterior part (10).

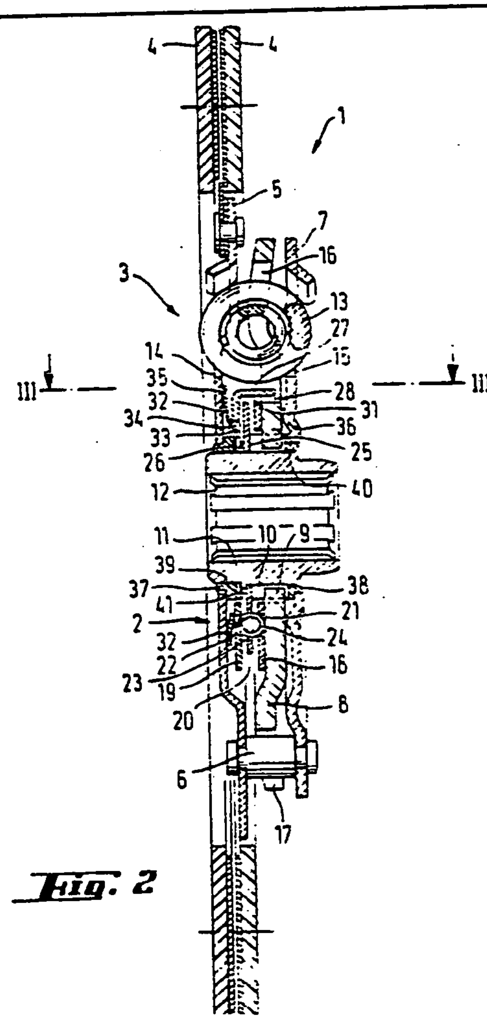

Fig. 2

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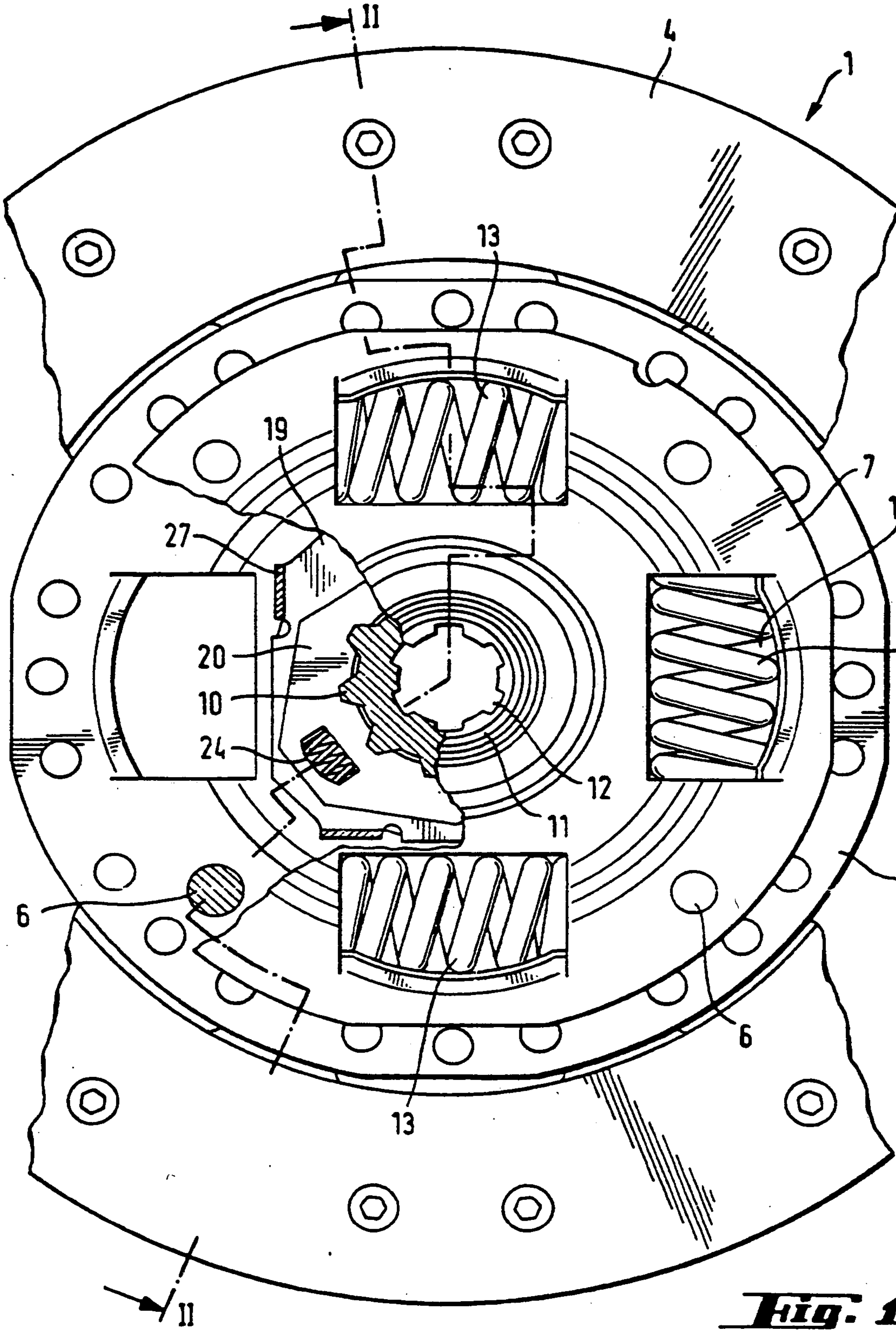

Fig. 1

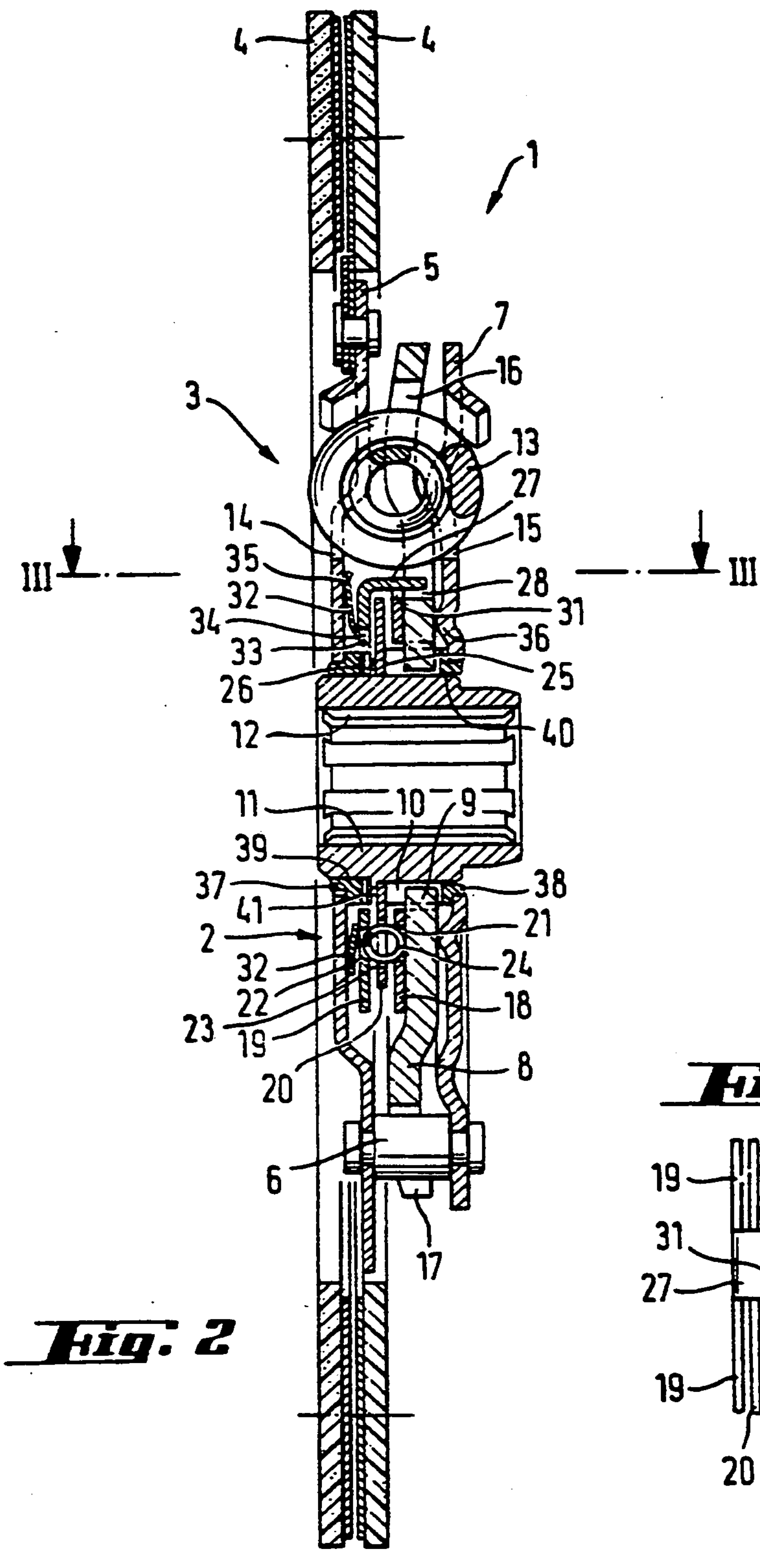
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Fig. 2

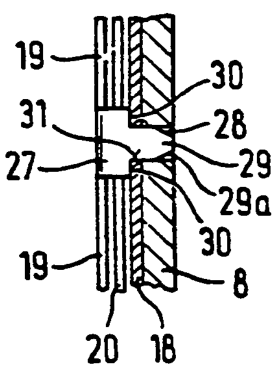
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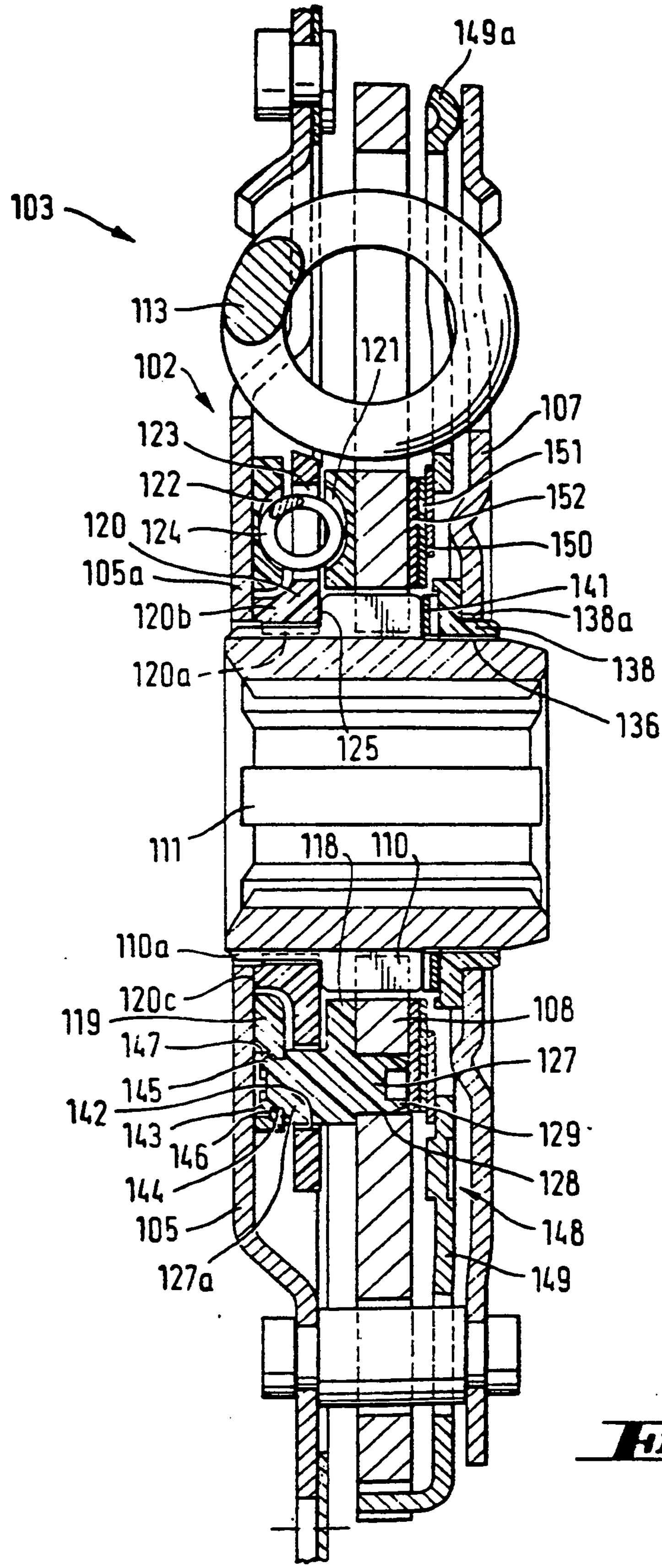
Fig. 3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125
111
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110
110a
120c
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105
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127a
149

Fig. 4

 DUPLICATE

TORSIONAL VIBRATION DAMPER

The invention relates to a torsional vibration damper, more especially for the clutch disks of motor vehicles, with a preliminary damping device having a force accumulator of relatively small stiffness and a main damping device having a force accumulator of relatively great stiffness, in which the force accumulators are operative between the input and output parts of the preliminary and main damping devices, the output part of the torsional vibration damper being a hub part having a shaped interior for mounting it on a gear shaft, on which hub part the output part of the preliminary damping device as well as a flanged part which forms the output part of the main damping device and has a shaped interior are mounted so as to be fixed for rotation therewith, in which this shaped interior is engaged with a shaped exterior part of the hub part, a limited amount of relative rotation of the flanged part of the main damping device with respect to the output part of the torsional vibration damper being possible via these shaped parts and in which in addition the input part of the torsional vibration damper is formed by two side plates which are axially spaced apart and accommodate the flanged part of the main damping device between them.

A torsional vibration damper according to the present invention is characterised in that preliminary damping device is arranged axially between the flanged part of the main damping device and one of the side plates which form the input part of the torsional vibration damper, in that at least one of the input parts of the main damping device is mounted on a shoulder of the hub part forming the output part of the torsional vibration damper by means of an L-shaped friction or bearing ring and in that between the L-shaped ring and the shaped exterior part of the hub is arranged a spring such as a corrugated spring, which is supported on one side against the latter and, on the other side, urges the side plate mounted by

the L-shaped ring in the direction away from the shaped exterior part.

The invention will be explained in greater detail with reference to the drawings, in which :-

Figure 1 is an elevation of a clutch disk with a broken away portion which partly shows the preliminary damping device,

Figure 2 is a section taken on the line II-II of Figure 1,

Figure 3 is a section taken on the line III-III of Figure 2, and

Figure 4 is a section of a detail of another embodiment.

The clutch disk 1 shown in Figures 1 to 3 has a preliminary damping device 2 and a main damping device 3. The input part of the clutch disk 1, which at the same time constitutes the input part of the main damping device 3, is formed by a carrier plate 5, which carries a friction lining 4, and by a counter plate 7 which is connected by spacing bolts 6 to the carrier plate 5 so as to be fixed for rotation therewith. The output part of the main damping device 3 is formed by a flange 8 having an inner row of teeth 9 which meshes with an outer row of teeth 10 on a hub member 11 which constitutes the output part of the clutch disk 1. Circumferential play corresponding to the operative range of the preliminary damping device 2 is present between the flanks of the teeth of the outer row of teeth 10 on the hub member 11 and the flanks of the teeth of the inner row of teeth 9 on the flange 8. The hub member 11 also has an inner row of teeth 12 for the mounting thereof on the input shaft of a gearbox.

The main damping device 3 has springs 13 which are provided in window-like openings 14, 15 in the carrier and counter plates 5, 7 on the one hand and in window-like openings 16 in the flange 8 on the other hand. Relative rotation against the action of the springs

13 is possible between the plates 5 and 7, which are connected so as to be fixed for rotation with each other, and the flange 8. This rotation is limited by impact of the spacing bolts 6, which interconnect the two plates 5 and 7, against the end edges of the openings 17 in the flange 8 through which they extend axially.

The preliminary damping device 2 is located axially between the flange 8 and the carrier plate 5. The input part of the preliminary damping device 2 is formed by two disks 18,19 which are axially spaced apart and are connected to the flange 8 so as to be fixed for rotation therewith. Moreover, these disks receive between them a disk-like flange 20 which constitutes the output part of the preliminary damping device 2 and is connected to the hub member 11 so as to be fixed for rotation therewith. A limited amount of relative rotation is possible between the two disks 18,. 19 and the flange 20 located between them corresponding to the play between the flanks of the teeth of the outer row of teeth 10 on the hub member 1 and the inner row of teeth 9 on the flange 8, this limited amount of relative rotation being against the action of force accumulators in the form of coiled compression springs 24 provided in window-like openings 21, 22 in the disks 18, 19 and in window-like openings 23 in the flange 20.

The flange 20 of the preliminary damping device 2 is supported axially against a shoulder 25 formed by a stepped portion of the outer row of teeth 10 on the hub member 11 and has on its inner edge a row of teeth which, in order to prevent it from rotating, engage in that part of the outer row of teeth 10 which is of reduced height. In order to fix it axially, the flange 20 is held against the shoulder 25 by an abutment 26.

The disks 18,19 of the preliminary damping device 2 are connected to the flange 8 by positive plug-in connections so as to be fixed for rotation therewith. For this purpose the disk 19 provided between the flange 20 and the carrier plate 5 has on its outer circumferential edge tongues 27 which extend axially in the direction towards the flange 8 of the main damping device 3 and

project axially into openings 28 in the flange 8. In the embodiment shown these openings 28 are connected to the openings 16 in the flange 8 for the reception of the springs of the main damping device. The tongues 27 extend axially over the disk-like flange 20 of the preliminary damping device and have in each case at their face ends a part 29 of reduced width which engages in a corresponding opening 28 in the flange 8 and forms a step 30. The disks 19 are supported axially against the flange 8 by the steps 30 of the tongues 27 with the interposition of the disk 18. The disk 18 which abuts axially against the flange 8 has cut-away portions 31 formed in its outer circumference through which those parts 29 of the tongues 27 which are of reduced width engage axially so as to fix the disk 18 axially and secure it against rotation with respect to the flange 8 of the main damping device. The reduced width parts 29 have, moreover, wedge-shaped tapered parts 29a which facilitate the threading (of the tongues) into the openings 28 and 31 and consequently improve the assembly of the clutch disk. For the purpose of axially securing the two disks 18 and 19 of the preliminary damping device 2 a plate spring 32 is arranged axially between the disk 19 and the carrier plate 5, this plate spring 32 being supported by its radially outer part against the carrier plate 5 and acting by means of its radially inner part so as to urge the disk 19 in the direction towards the flange 8, as a result of which the tongues 27 are supported via their stepped parts 30 against the disk 18 and urge the latter against the flange 8. The plate spring 32 has on its inner region projections 33 which engage in openings 34 in the disk 19 in order to fix the plate spring 32 for rotation with the flange 8. In order to produce a frictional damping action, the plate spring 32 has on its radially outer region a rounded off formation 35 which bears against the carrier plate 5 under the prestress of the plate spring 32. The prestress of the plate spring 32 moreover causes the counter plate 7, which is located on the other side of the flange 8, to be drawn axially in the direction towards the flange 8. The counter plate 7 has, in the region of its radially inner edge, a corrugated formation 36 which bears against the flange 8 under the action of the axial force exerted by the plate spring 32 so as to produce a frictional damping effect.

The carrier plate 5 and the counter plate 7 moreover are each mounted on a shoulder 39, 40 of the hub member 11 via an L-shaped friction or bearing ring 37,38. Between the radially extending limb of the friction or bearing ring 37,38, which supports the carrier plate 5, and the abutment 26 or the disk-like flange 20 of the preliminary damping device 2 there is arranged a prestressed corrugated washer 41 which urges the carrier disk 5 axially in the direction away from the outer row of teeth 10 so that the radially extending limb of the friction or bearing ring 38 is clamped axially between the counter plate 7 and one end face of the outer toothed ring 10.

Starting from the neutral position of the clutch disk 1, when relative rotation takes place between the input part of the clutch disk 1 formed by the plates 5 and 7 with respect to the hub member 11, first of all the force accumulators 24 of the preliminary damping device 2 and the two friction or bearing rings 37,38 come into operation. As soon as the play between the flanks of the teeth of the outer row of teeth 10 on the hub member 11 and those of the inner row of teeth 9 on the flange 8 has been taken up, the preliminary damping device 2 is bypassed, so that, on continued relative rotation between the two plates 5, 7 and the hub member 11, only the force accumulators 13 of the main damping device 3 are operative. A frictional damping is operative in addition to the force accumulators over the range of rotation of the main damping device 3, which frictional damping is produced both by the two friction or bearing rings 37,38 and also predominantly by frictional contact of the plate spring 32 with the carrier plate 5 and of the corrugated formation 36 with the flange 8.

In the modified embodiment according to Figure 4, the flange 120 which constitutes the output part of the preliminary damping device 102 is formed by a plastics part which is advantageously fibre-reinforced. The flange 120 is supported axially against a shoulder 125 formed by a partially stepped portion of the outer row of teeth 110 on the hub member 111 and has on its inner edge a row

of teeth 102a which mesh with that part 110a of the outer row of teeth 110 which is of reduced height. The flange 120 has an axial extension 120b the end surface 120c of which is abutted axially by the radially inner part 105a of the carrier disk 105. The counter plate 107 located on the other side of the outer row of teeth 110 is radially supported on a shoulder 136 of the hub member 111 via a friction or bearing ring 138 of angular cross-section. A prestressed corrugated washer 141 is located axially between the radially directed limb 138a of the friction or bearing ring 138 and the outer row of teeth 110. The axial force exerted by the corrugated washer 141 causes the flange 120 of the preliminary damping device 102 to be axially clamped between the end surface 125 of the outer row of teeth 110 and the carrier plate 105, so that, when relative rotation occurs between the carrier plate 105 and the hub member 111, frictional damping is produced between the radially inner part 105a of the carrier plate 105 and the end surface 120c of the flange 120.

The disks 118, 119 provided on each side of the flange 120, which form the input part of the preliminary damping device 102, are also constituted by plastics parts which may be fibre-reinforced. These disks 118,119 are connected either directly or indirectly with the flange 108, which constitutes the output part of the main damping device, via positive push-in connections, so that the said disks 118, 119 are fixed for rotation with the said flange 108. For this purpose, the disk 118 located between the flange 120 of the preliminary damping device 102 and the flange 108 of the main damping device has plug-like projections 127 which extend axially into openings 128 in the flange 108. The plug-like projections 127 have at their free ends radially resiliently flexible parts 129 which are formed with barbs and engage in the openings 128. On the side thereof which faces away from the flange 108 the disk 118 has axial projections 127a which extend axially through openings 142 in the flange 120. Each of the axial projections 127a has at its free end an at least partly elastically deformable part 143 which extends axially through an opening 144 in the disk 119 and engages by means of a barbed part 145 behind a shoulder 146 on the disk 119 so as to

fix the disk 119 axially with respect to the disk 118 or the flange 108. The shoulders 146 on the disk 119 are formed by means of depressions 147. The disk 119 which is made of a plastics material is in direct frictional contact with the carrier plate 105 and serves for producing frictional damping of the main damping device. Such a construction of the preliminary damping device is particularly advantageous since the number of friction rings can be reduced, because the disk 119 undertakes two functions, namely on the one hand it forms a holder for the springs of the preliminary damping device and on the other hand it serves as a friction ring. Also, a preliminary damping device constructed in this manner can be produced very economically since the disks 118,119 and the flange 120 can be made in a simple manner by injection moulding and the two disks 118 and 119 can be connected to each other and to the flange 108 by simple snap-action connections, so that they are fixed to each other rotationally and axially.

The disks 118, 119 and the flange 120 have windows or openings 121, 122, 123 for the reception of the force accumulators or coil springs 124 of the preliminary damping device 102.

Between the flange 108 and the counter plate 107 there is provided a load friction device 148 comprising a load friction disk 149 which cooperates with springs 113 of the main damping device 103. The load friction disk 149 has in its radially outer part toroidal embossments 149a by means of which it is supported against the counter plate 107 so as to produce a frictional damping action. The radially inner part of the load friction disk 149 is biased axially by a plate spring 150 in the direction towards the counter plate 107. The prestressed plate spring 150 is moreover supported against a pressure plate 151 which presses a friction ring 152 against the flange 18. The plate spring 150 also causes the two disks 118, 119 of the preliminary damping device 102 to be compressed axially between flange 108 and the carrier plate 107.

The invention is not limited to the embodiments shown, but relates generally to clutch disks in which the preliminary damping

device is located in the axial region between a carrier- or counter-plate and a hub flange, the latter being capable of rotary play with respect to the hub part and the damping springs of the preliminary damping device being furthermore laterally or radially covered by the carrier- or counter-plate.

Features of the clutch disks and torsional vibration dampers described above from the subjects of co-pending application Nos. 8529011 and 8825111.1.

Claims

1. Torsional vibration damper, in particular for the clutch disks of motor vehicles, with a preliminary damping device having a force accumulator of relatively small stiffness and a main damping device having a force accumulator of relatively great stiffness, in which the force accumulators are operative between the input and output parts of the preliminary and main damping devices, the output part of the torsional vibration damper being a hub part having a shaped interior for mounting it on a gear shaft, on which hub part the output part of the preliminary damping device as well as a flanged part, which forms the output part of the main damping device and has a shaped interior, are mounted so as to be fixed for rotation therewith, in which this shaped interior is in engagement with a shaped exterior part of the hub part, a limited amount of relative rotation of the flanged part of the main damping device with respect to the output part of the torsional vibration damper being possible via these shaped parts and in which in addition the input part of the torsional vibration damper is formed by two side plates which are axially spaced apart and accommodate the flanged part of the main damping device between them, characterised in that the preliminary damping device (2, 102) is arranged axially between the flanged part (8, 108) of the main damping device (3, 103) and one of the side plates (5,7;105,107) which form the input part of the torsional vibration damper (1), in that at least one of the input parts (5,7; 105,107) of the main damping device (3,103) is mounted on a shoulder (39,136) of the hub part (1) forming the output part of the torsional vibration damper by means of an L-shaped friction or bearing ring (37,138) and in that between the L-shaped ring (37,138) and the shaped exterior part of the hub is arranged a spring such as a corrugated spring (41,141), which is supported on one side against the latter and, on the other side, urges the side plate (5,107) mounted by the L-shaped ring (37,138) in the direction away from the shaped exterior part (10,110).

2. Torsional vibration damper according to claim 1, characterised

in that the spring (141) together with the L-shaped ring is on the side of the said shaped exterior part (110) to the flange (120) of the preliminary damping device.

3. Torsional vibration damper according to claim 1 or 2, characterised in that the input part of the preliminary damping device (2,102) is formed by two axially spaced apart disks (18,19; 118,119) which are fixed for rotation with the flanged part (8,108) of the main damping device (3,103) and have openings (21,22; 121,122) for the reception of the force accumulators (24,124) of relatively small stiffness.

4. Torsional vibration damper according to claim 3, characterised in that the output part of the preliminary damping device (2,102) is formed as a radially extended flange which is fixed for rotation with the output part of the torsional vibration damper, lies axially between the disks (18,19; 118,119) forming the input part and has an opening (23) for a reception of the or each respective force accumulator of relatively small stiffness.

5. Torsional vibration damper according to claim 3 or 4, characterised in that one (18, 118) of the disks (18, 19; 118, 119) which form the input part of the preliminary damping device (2, 102) abuts directly against the flanged part (8, 108) of the main damping device (3, 103).

6. Torsional vibration damper according to any of claims 3 to 5, characterised in that the disks (18, 19; 118, 119) of the preliminary damping device (2, 102) are fixed for rotation with the flanged part (8,108) of the main damping device (3, 103) by means of positively engaging push-in connections.

7. Torsional vibration damper according to any of claims 3 to 6, characterised in that the other disk (19) of the preliminary damping device (2) which is axially further removed from the flanged part (8) of the main damping device (3) has axial tongues (27) which engage in openings (28) in the flanged part (8) of the main damping

device (3).

8. Torsional vibration damper according to claim 7, characterised in that at least some of the tongues (27) have in each case at the free end thereof a part (29) of reduced width which forms a step (30) and engages in the corresponding opening (28) in the flanged part (8) of the main damping device (3) and the other disk (19) of the preliminary damping device (2) is supported axially by the steps (30) of the tongues (27) against the flanged part (8) of the main damping device (3).

9. Torsional vibration damper according to claim 8, characterised in that the said one (18) of the disks (18,19) of the preliminary damping device (2) has openings (31) through which the parts (29) of reduced width of the tongues (27) of the said other disk (19) of the preliminary damping device (2) engage axially in order to fix the said one disk (18) of the preliminary damping device (2) axially and rotationally with respect to the flanged part (8) of the main damping device (3).

10. Torsional vibration damper according to claim 8 or 9, characterised in that the said other disk (19) of the preliminary damping device (2) is supported axially by the stepped parts (30) of the tongues (27) against the said one disk (18) of the preliminary damping device (2) and presses the latter against the flanged part (8) of the main damping device (3).

11. Torsional vibration damper according to any of claims 7 to 10, characterised in that the tongues are tapered inwardly at least in the region of their free ends - considered in an axial direction.

12. Torsional vibration damper according to any of claims 7 to 11, characterised in that the said other disk (19) of the preliminary damping device (2) is urged axially by a force accumulator (32) in the direction towards the flanged part (8) of the main damping device (3).

13. Torsional vibration damper according to any of claims 3 to 12, characterised in that a pre-stressed force accumulator (32) is located between the said other disk (19) of the preliminary damping device (2) and the adjoining side plate (5) of the input part (5 + 7) of the torsional vibration damper (1) and urges the other disk (19) of the preliminary damping device (2) in the direction towards the flanged part (8) of the main damping device (3).

14. Torsional vibration damper according to any of the preceding claims, characterised in that the side plate located on that side of the flanged part (8) of the main damping device (3) which is remote from the preliminary damping device (2) is formed with a corrugation or bead-like annular friction area (36) by means of which it bears directly against the hub part (8) of the main damping device (3).

15. Torsional vibration damper according to claim 14, characterised in that the friction area (36) is formed on the radially inner peripheral part of the side plate (7).

16. Torsional vibration damper according to any of the preceding claims, characterised in that the side plates (5, 7; 105, 107) which constitute the input part (5 + 7; 105 + 107) of the torsional vibration damper (1) serve at the same time as the input part of the main damping device (3).

17. Torsional vibration damper according to any of the preceding claims, characterised in that the side plate (5, 105) adjacent to the preliminary damping device (2, 102) constitutes the lining carrier disk.

18. Torsional vibration damper according to any of the preceding claims, characterised in that the flange (20) of the preliminary damping device (2) is axially supported against the outer shaped part (10) of the hub part which forms the output part (11) of the torsional vibration damper (1).

19. Torsional vibration damper, according to any of the preceding

claims, characterised in that the input part and/or the output part of the preliminary damping device is (or are) made of plastics material.

20. Torsional vibration damper according to claim 19, characterised in that the flange (120) of the preliminary damping device (102) is a plastics part which, by means of window-like opening (123), accommodates tangentially or chordally disposed force accumulators (124), the moment exerted by these force accumulators being transmissible by means of the plastics part (120) to the output part (111) of the torsional vibration damper.

21. Torsional vibration damper according to claim 19 or 20, characterised in that the flanged part (120) which is composed of plastics material is provided with an internal row of teeth (120<u>a</u>) which is supported on the external row of teeth (110<u>a</u>) of the output part (111) of the torsional vibration damper.